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SPECIFICATION FOR ACRYLIC RESIN TEETH

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MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

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June 1976

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SPECIFICATION FOR
ACRYLIC RESIN TEETH

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(*Continued on page 2*)

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(*Continued from page* 1)

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Indian Standard

SPECIFICATION FOR ACRYLIC RESIN TEETH

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 30 January 1976, after the draft finalized by the Dental Materials Sectional Committee had been approved by the Chemical Division Council.

0.2 Plastic teeth, made essentially of acrylic resins, are suitable for the construction of complete or partial artificial dentures.

0.3 In the preparation of this standard, considerable assistance has been derived from the following standards:

SAA T. 20-1961 Synthetic resin teeth. Standards Association of Australia.

ASA — Z93.15-1962 Acrylic resin teeth. American Standards Association.

0.4 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard prescribes the requirements and the methods of sampling and test for acrylic resin teeth.

2. TYPES

2.1 Acrylic resin teeth shall be of the following types:

Type 1 — Anterior Teeth — approximating the various forms of human anterior teeth;

Type 2 — *Anatomic Posterior Teeth* — approximating the various forms of human posterior teeth; and

Type 3 — Non-anatomic Posterior Teeth — approximating the forms of human posterior teeth but having modified occlusal surfaces.

---

*Rules for rounding off numerical values (*revised*).

3. REQUIREMENTS

3.1 Description -The teeth shall consist of methyl methacrylate polymer, co-polymers of methacrylates or combinations of synthetic resins having suitable properties for use as artificial teeth. The teeth shall not produce local tissue reaction or general toxic effects.

3.2 Size **and Shape-** Sizes and shapes shall be as specified by the purchaser.

3.3 **Blend** — All teeth, anterior and posterior, shall consist of a gingival or body portion and a more translucent incisal or occlusal portion; the two shall be blended in such a manner as to simulate natural teeth with no line of demarcation between incisal (occlusal) and gingival portions on the labial (buccal) aspects of the teeth.

3.4 **Colour** -The shades of the teeth shall be as specified by the purchaser. The shades of teeth shall be reproductions of those found in human teeth, ranging from the light shades of young persons to the dark shades of the elderly. The shades of the colours shall be stable in normal conditions *in vivo* and *in vitro.* The shades of the teeth shall match the manufacturer's shade guide within the limits of professional acceptance.

3.5 **Porosity-The** teeth shall be free of porosity, either on or within 2 mm of the surface when sectioned and observed under low magnification (10 x).

3.6 **Surface Finish**

3.6.1 *Retention of Finish* -The original finish of the teeth shall be maintained during processing and reprocessing to such a degree that light buffing will restore them to their original condition when tested as prescribed in **A-l.**

3.6.2 *Retention of Polish-* The teeth shall be capable of being grounded and polished to a glossy surface when tested as prescribed in **A-l.**

3.6.3 *Staining-* The teeth shall not stain in service under normal conditions and any deposit shall be removed by light buffing (set 3.6.1) without marring the original surface.

3.7 **Blushing-The** teeth shall not blush, blanch or change colour when tested as prescribed in A-2.

3.8 **Distortion** -The teeth shall not distort or change in shape when placed in boiling water at approximately 100°C for 3 hours as prescribed in A-2.

3.9 **Resistance to Craze** — The teeth, when tested as prescribed in A-2, shall be craze resistant both before and a&r being subjected to the curing cycle in a water-bath.

3.10 Bonding -The teeth, when cured with acrylic resin denture base material, shall comply with the requirements of bonding test as prescribed in A-3.

3.11 Hardness -The incisal or occlusal surface shall have a knoop indentation hardness of not less than **15·0 kgf/mm^2,** when tested as prescribed in A-#.

3.12 **Resistance to Indentation** -The body (gingival) portion of the teeth shall not be indented more than 0·11 mm by a 12·7 mm diameter steel ball loaded at 30 kgf for 10 minutes when tested as prescribed in A-5. The recovery of the depth of the indentation shall be at least 80 percent in 10 minutes after the 30-kgf load is released.

3.13 Stability of Colour to Light-The teeth shall not show more than a slight change in colour when tested as prescribed in A-6.

3.14 Stability of Colour to Sulphides — The teeth shall not perceptibly change in colour when tested as prescribed in A-7.

3.15 Stability of Colour to Denture Immersion Cleaner -The teeth shall show not more than a slight change in colour when tested as prescribed in A-8.

4. PACKING AND MARKING

4.1 Packing-The material shall be packed as agreed to between the purchaser and the supplier.

4.2 Marking — Each package shall be securely closed and shall bear legibly and indelibly the following information:

a) Name and type of the material;
b) Shade of the teeth;
c) Manufacturer's name and his recognized trade-mark, if any;
d) No. of teeth in the package; and
e) Batch number.

4.2.1 The packages may also be marked with the ISI Certification Mark.

NOTE -The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. IS1 marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the IS1 Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

5. SAMPLING

5.1 The method of preparing samples of the material and the criteria for conformity shall be as given in Appendix **B.**

6. TEST METHODS

6.1 Tests shall be carried out according to the methods prescribed in Appendix A. Reference to relevant clauses of Appendix A is given in **3**.

6.2 Quality of Reagents — Unless specified otherwise, pure chemicals and distilled water (*see* IS: 1070-1960*) shall be employed in tests.

NOTE — 'Pure chemicals' shall mean chemicals that do not contain impurities which affect the results of analysis.

APPENDIX A

(*Clauses* 3.6 *to* 3.15 *and* 6.1)

METHODS OF TEST FOR ACRYLIC RESIN TEETH

A-1. TEST FOR SURFACE FINISH

A-1.1 Apparatus

A-1.1.1 *Polisher* — a soft 3-row muslin wheel, approximately 7·5 cm in diameter and having a speed of 3 500 ± 500 rev/min.

A-1.1.2 *Grinder* — silicon carbide wheel (medium grit) of 20 mm diameter and 5·0 mm thickness.

A-1.2 Procedure — Process three teeth to a denture base resin, using the customary denture compression packing technique. The teeth shall be in contact with artificial stone (hydrocal) used as the investing material. Heat the flask in a water-bath at 73 ± 1°C for $1\frac{1}{2}$ hours and then in boiling water for 30 minutes. Cool the flask in air for 30 minutes and then in water at 23 ± 10°C for 15 minutes. After removal from the flask, polish the teeth for not longer than 1 minute with the muslin wheel rotating at a speed of 3 500 ± 500 rev/min. Prepared chalk suspended in water shall be used as the abrasive. Hold the teeth against the wet wheel under a light load. After polishing, the surface of the processed teeth shall be equal in finish to that of the teeth as received.

A-1.2.1 Roughen the occlusal surface of one of the processed teeth by grinding with silicon carbide wheel. Polish the ground surface with muslin and chalk as prescribed in **A-1.2**. The polished surface shall be equal to that of the teeth as received. All comparisons shall be made by visual inspection.

---

*Specification for water, distilled quality (*revised*).

A-2. TEST FOR RESISTANCE TO BLUSHING, DISTORTION AND CRAZE

A-2.1 Reagent

A-2.1.1 *Methyl Methacrylate Monomer*

A-2.2 Procedure — Examine one or more teeth of each shade for blushing and distortion after subjecting to the following testing cycle:

> Submerge the teeth in test tubes of water placed in a water-bath so that the test tubes do not contact the vessel. Heat the water-bath from room temperature to 100°C in 5 to 20 minutes, and hold at boiling temperature (approximately 100°C) for 3 hours. Remove the teeth and cool to room temperature.

A-2.2.1 Conduct the test for resistance to craze on one or more teeth of each shade in the as-received condition and on one or more teeth of each shade after the teeth have been subjected to the testing cycle described in **A-2.2.** Immerse the teeth in methyl methacrylate monomer for 5 seconds and remove. Repeat this immersion after 1 minute and allow the teeth to dry on a towel for 2 hours at room temperature. Examine for any blushing, blanching, or change in colour, and distortion or any cracks, by visual examination or low power magnification (10 ×).

A-3. TEST FOR BONDING STRENGTH

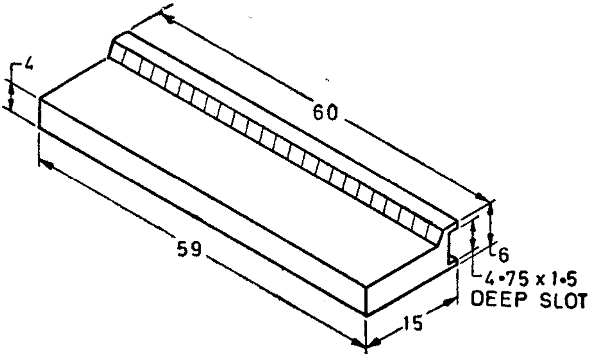
A-3.1 Apparatus

A-3.1.1 *Metal Mount* — of dimensions as given in Fig. 1, slightly tapered and provided with a trough 4·75 mm wide and 1·5 mm deep to receive wax.

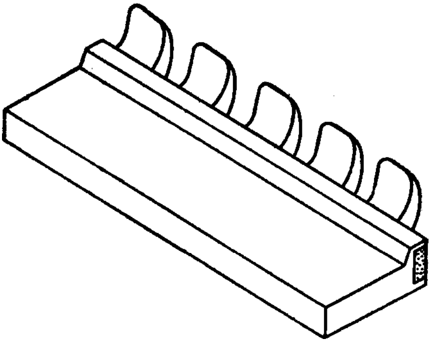
A-3.1.2 *Pulling Machine* — As illustrated in Fig. 2.

A-3.2 Procedure

A-3.2.1 Ground a set of 6 upper anteriors on the ridge lap sufficiently to represent gum fitted teeth. Set these up in a straight line, spaced 1·5 mm apart, on the metal mount provided with a trough. Wax the teeth to the metal mount in such a manner that the incisal end protrudes freely beyond the metal mount, and the ridge lap is in such a position that when wax is extended to cover half-way over the ridge lap it is flush with the metal mount. Restrict the wax on the cingulum to the level of the metal mount. Flask the mounted teeth and remove the metal mount, leaving the teeth in the flask. Remove the wax completely from the teeth by rinsing with a near boiling detergent solution and finally rinsing with water. Process acrylic resin denture base material on to the teeth in accordance with the manufacturer's instructions.



1A SUITABLE METAL MOUNT FOR SETTING THE TEETH



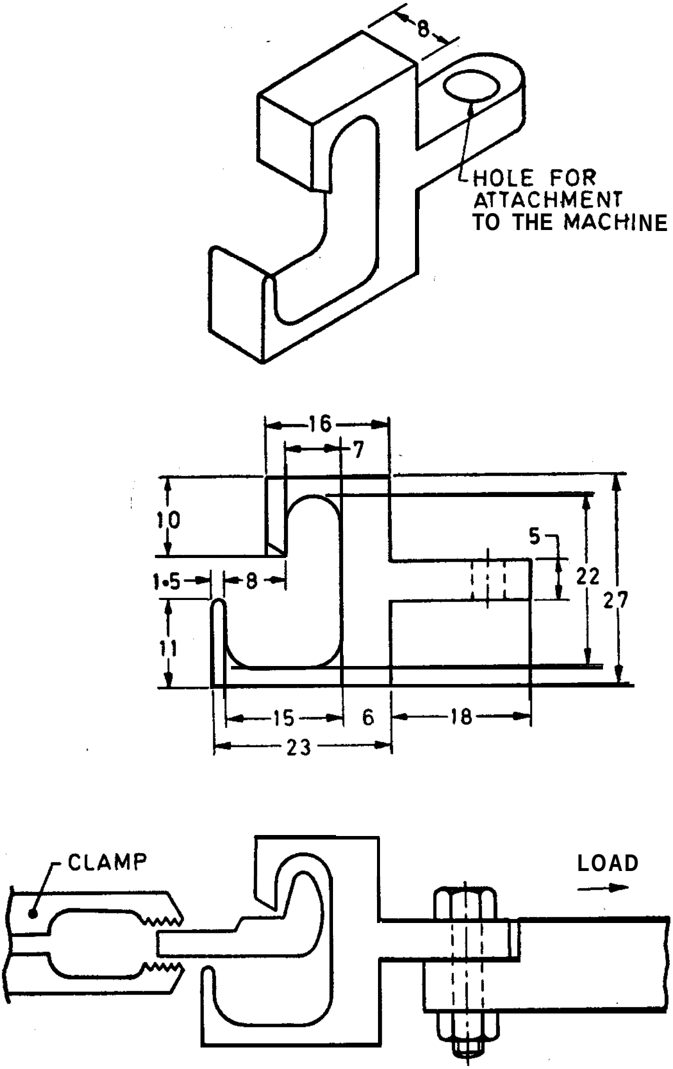
16 TEETH SET IN ACRYLIC RESIN AFTER FLASKING

All dimensions in millimetres.

FIG. 1 BONDING TEST

A-3.2.2 Clamp the teeth with the plastic mount to a machine designed so as to permit a direct pull on the cingulum at a consistent height on each tooth above the acrylic bar. The grapple for this purpose shall not permit lateral deflection or change of position.

A-3.2.3 The bond shall be deemed satisfactory if no tooth separates clearly from the plastic mount when direct traction is gradually applied to it.



GRAPPLE WITH TOOTH IN POSITION

All dimensions in millimetres.

FIG. 2 SUITABLE TYPE OF GRAPPLE FOR BONDING TEST

A-4. DETERMINATION OF HARDNESS

A-4.1 Procedure — Determine the hardness on the occlusal or incisal portion of the teeth by the knoop indentation method using a rate of descent of not less than 1 mm/minute and not more than 18 mm/minute and a 20 second contact with a 100-gf load.

A-4.1.1 Prepare the specimens by taking one transverse section parallel to the incisal (Type 1) or the occlusal (Type 2) surface. The sections shall be 2·5 ± 0·5 mm thick with the top and bottom surfaces flat and parallel. The top surface of the specimen on which the indentation is to be made shall be 1·5 ± 0 5 mm from the incisal edge or tip of the cusp if the cuspid is used (Type 1) or the tips of the occlusal cusps (Type 2). Polish the specimens by using progressively finer abrasive papers. Finally polish the specimens to glossy surface by magnesium oxide in a water suspension on cloth-covered laps rotating at 250 rev/min.

A-4.1.2 Make ten equally spaced indentations on each of the four specimens and record the average value of the 40 indentations to the nearest 0·1 kgf/mm^2.

A-5. DETERMINATION OF RESISTANCE TO INDENTATION AND RECOVERY

A-5.1 Apparatus

A-5.1.1 *Rockwell Superficial Hardness Tester*

A-5.2 Procedure — Prepare three test specimens as prescribed in **A-4.1.1.**

A-5.2.1 Determine the resistance to indentation by using Rockwell superficial hardness tester. The bottom surfaces of the specimen, on which the indentation is to be made, shall be 4·5 ± 0·5 mm from the incisal edge or the tip of the cusp, if the cuspid is used (Type 1) or the tips of the occlusal cusps (Type 2). Subject each specimen to a minor load of 3 kgf employing a steel ball 12·7 mm in diameter, and adjust the dial gauge to zero. Then apply a major load of 30 kgf for 10 minutes, read the depth of the indentation at this time from the dial gauge and record to the nearest 0·001 mm as reading *A*. Now release the major load, leaving the minor load on the specimen. Read the dial gauge again after 10 minutes and record the value as *B*. Take the average of the three specimens for reading *A* and for reading *B* and round off to the nearest 0·01 mm. Record the even number when the final value falls midway between two numbers.

A-5.2.2 *Calculation* — Calculate the percentage of recovery as follows:

$$\text{Recovery, percent} = \frac{\text{Average } A - \text{Average } B}{\text{Average } A} \times 100$$

A-6. TEST FOR COLOUR STABILITY TO LIGHT

A-6.1 Apparatus

A-6.1.1 *Lamp*—As shown in Fig. 3. It shall be provided with a bulb which has been in use for not less than 50 hours and nor more than 400 hours. The light source shall be a combination tungsten filament-mercury vapour type enclosed in glass which has transmission below 280 nm. The lamp shall be rated at 400 watts. The specimen shall be carried on an aluminium disc which is centred under the bulb and resting on a phonograph turntable, operated at 33 rev/min. The specimen shall be held by secrews approximately 5 mm above the disc and 127 mm from the centre of the disc and shall be maintained between 60°C and 65°C. The plane of the top surface of the specimen shall be 178 mm from the bottom of the bulb.

A-6.2 Procedure — Test at least one tooth of each shade. Place the teeth in the holders provided and the aluminium disc centred under the bulb so that the plane of the specimens is 180 mm below the bottom of the bulb. Revolve the turntable and disc at 33 rev/min and expose the specimens to the radiation of the lamp for 24 hours after which period remove each tooth and compare visually for change in colour with a tooth of the same original shade by visual inspection in bright diffuse daylight.

A-7. TEST FOR COLOUR STABILITY TO SULPHIDE

A-7.1 Reagent

A-7.1.1 *Sodium Sulphide Solution* — Dissolve 5·0 g of sodium sulphide (Na_2S) in 100 ml of water.

A-7.2 Procedure — Take at least one tooth of each shade and immerse in sodium sulphide solution for 24 hours. Take out the tooth and wash thoroughly with water. Compare the change in colour with a tooth of the same original shade, which has been immered in water for 24 hours, in bright diffuse daylight.

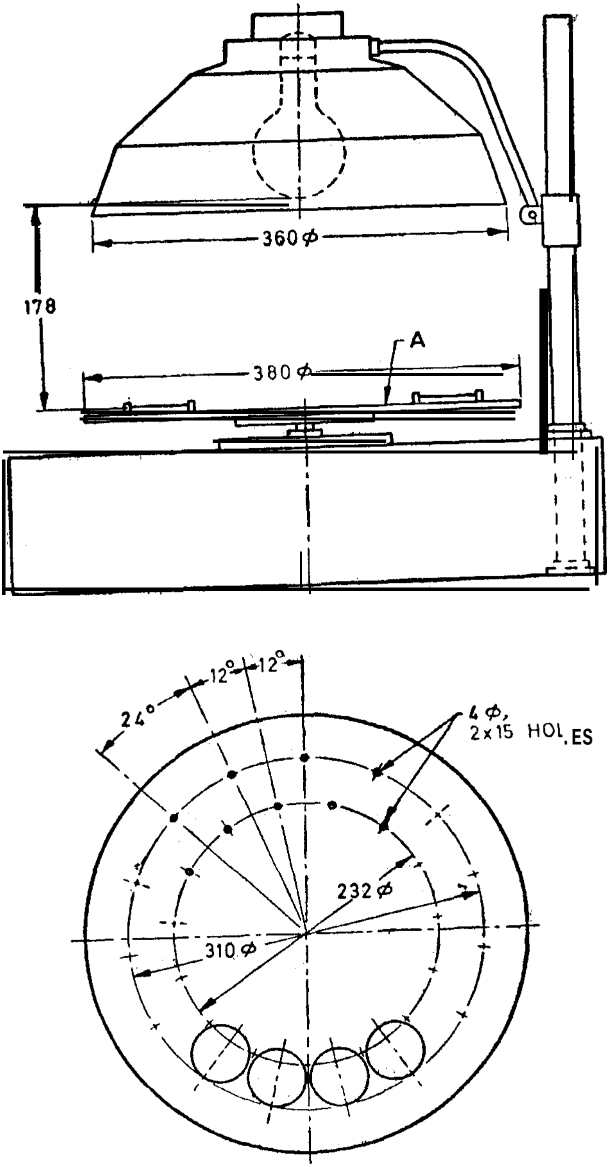
A-8. TEST FOR COLOUR STABILITY TO DENTURE IMMERSION CLEANER

A-8.1 Reagents

A-8.1.1 *Sodium Perborate Solution* — Prepare a saturated solution of sodium perborate in water.

A-8.1.2 *Trisodium Phosphate Solution* — Dissolve 10 g of trisodium phosphate ($Na_3PO_4.12H_2O$) in 100 ml of water.

A-8.1.3 *Sodium Hypochlorite Solution* — Prepare aqueous solution of sodium hypochlorite having 1·0 percent available chlorine.



TOP PLAN OF A

All dimensions in millimetres.

FIG. 3 APPARATUS FOR COLOUR STABILITY TEST

A-8.2 Procedure

A-8.2.1 Take at least one separate tooth for each shade and immerse for 48 hours respectively in each of the following solutions:

a) Sodium perborate,
b) Trisodium phosphate, and
c) Sodium hypochlorite.

A-8.2.2 Compare the change in colour with a tooth of the same original shade, which has been immersed in water for 24 hours, in bright diffuse daylight.

APPENDIX B

(Clause 5.1)

SAMPLING OF ACRYLIC RESIN TEETH

B-l. GENERAL REQUIREMENTS OF SAMPLING

B-l.0 In drawing, preparing, storing and handling test samples, the precautions and directions given in B-l.1 to B-l.5 shall be observed.

B-l.1 Samples shall not be taken in an exposed place.

B-l.2 The sampling instrument shall be clean and dry.

B-l.3 Precautions shall be taken to protect the samples, the material being sampled, the sampling instrument and the containers for samples from adventitious contamination.

B-l.4 The samples shall be placed in clean, dry, airtight glass or other suitable containers.

B-l.5 Each sample container shall be sealed airtight with a suitable stopper after filling, and marked with full details of sampling, the date of sampling and the year of manufacture of the material.

B-2. SCALE OF SAMPLING

B-2.1 Lot — All the containers in a single consignment of the material drawn from a single batch of manufacture shall constitute a lot. If a consignment is declared or known to consist of different batches of manufacture, the containers belonging to the same batch shall be grouped together and each such group shall constitute a separate lot.

B-2.1.1 Samples shall be tested from each lot for ascertaining conformity of the material to the requirements of the specification.

B-2.2 The number of containers (n) to be selected from the lot shall depend on the size of the lot (N) and shall be as given in Table 1.

TABLE 1 NUMBER OF CONTAINERS TO BE SELECTED FOR SAMPLING

LOT SIZE N (1)	NO. OF CONTAINERS TO BE SELECTED n (2)
up to 50	3
51 ,, 200	4
201 ,, 400	5
401 ,, 650	6
651 ,, 1 000	7
1 000 and above	8

B-2.3 The containers shall be selected at random from the lot and in order to ensure the randomness of selection, the random sampling methods given in IS : 4905-1968* may be followed.

B-3. TEST SAMPLES AND REFEREE SAMPLE

B-3.1 Preparation of Test Samples

B-3.1.1 Select six complete sets of upper and lower teeth of any type to conduct tests for all the requirements given under 3.

B-3.1.2 These sets shall be divided into three parts, one for the purchaser, another for the supplier and and third for the referee.

B-3.2 **Referee Sample** — The referee sample shall bear the seals of the purchaser and the supplier. It shall be kept at a place agreed tobetween the purchaser and the supplier and shall be used in case of dispute between the two.

B-4. NUMBER OF TESTS

B-4.1 Tests for all the requirements given in 3 shall be conducted on the composite sample.

B-5. CRITERIA FOR CONFORMITY

B-5.1 The lot shall be declared as conforming to this specification if the sample satisfies the requirements given in 3. If the requirements for any of the characteristics are not met, the lot shall be declared to have not satisfied the requirements of the specification.

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*Methods for random sampling.